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COMPRESSIVE STRENGTH OF REINFORCES CONCRETE BEAMS EXPOSED TO MARINE ENVIRONMENT BY USING A NON-DESTRUCTIVE TEST (NDT)

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ABSTRACT

Seawater attacks cause marine concrete constructions to have a substantially shorter actual life than their intended service life. Corrosion-induced deterioration is one of the main causes of the decline in the structural serviceability and dependability of reinforced concrete (RC) structures, particularly those exposed to marine environments. Quality assurance during and after new structural construction and reconstruction processes, the characterization of material qualities, damage as a function of time, and environmental effects are becoming major concerns. One of the jetties in Malaysia was founded with the deterioration of structures. The jetty has been repaired in 2020. The issue at the jetty was, the sea level rise during the concrete work, and it was discovered that the seawater had penetrated the concrete mix through the gaps in the formwork. After the striking of formwork, it was discovered that there were hairline cracks with a width is 0.2 mm on the surface of the beam, and there were also bungholes with various sizes on the surface of the beam after the concrete work was carried out. It is worried that cracks and bungholes on the surface of the reinforced concrete beam will affect the structure's integrity and accelerate the reinforcing steel's rusting process as the structure is exposed to the splash zone area. Concerning that, this study was conducted to determine and analyze the compressive strength of repaired reinforced concrete beams located in splash zone areas using the Non-Destructive Test (NDT) method, to assess the crack pattern of grade C30 concrete beams exposed to the marine environment through compression cube test and flexural loading test, and to analyze the compressive strength test of the concrete that has been mixed with the seawater.

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INTRODUCTION

1.1 Introduction

Seawater attacks cause marine concrete constructions to have a substantially shorter actual life than their intended service life. Reinforcement corrosion caused by chloride is thought to be the main cause of durability problems. Despite introducing corrosion-resistant reinforcements such as stainless steel and fibre-reinforced polymers (FRP), carbon steel remains indispensable in field construction because of its numerous practical benefits, such as low cost, simple field processing, and versatile mechanical performances. The alkaline concrete pore solution in reinforced concrete (RC) systems provides chemical protection for the steel reinforcements. In contrast, dense concrete materials are a barrier to prevent aggressive species from entering the system. This implies that the durability of reinforced concrete in a marine setting depends critically on the material's ability to withstand attacks by seawater. However, improper combination material selection or insufficient quality control during construction impacts the longevity and real service life of concrete. It was established that the structure was designed and constructed with inadequate qualitative standards given the exposed conditions. Strict concrete design is necessary to prevent corrosion of the steel reinforcement. Concrete's permeability is crucial for durability since all hostile ions pass via the pore structure (Yi et al., 2020).

Corrosion-induced deterioration is one of the main causes of the decline in the structural serviceability and dependability of reinforced concrete (RC) structures, particularly those exposed to maritime environments. The current probability-based approaches recommended by codes treat the durability parameters as random variables; regrettably, this does not allow for a full consideration of the damage/deterioration scenario of a structure, which may vary spatially due to variations in the concrete cover thickness, diffusivity, and other factors. It is common to refer to the chloride-induced deterioration of RC as a three-phase process that consists of crack initiation, crack propagation, and chloride intrusion. From the start of service until the steel starts to corrode is the first phase. Steel corrosion mostly controls the crack initiation and propagation during the second and third phases. Research has revealed that the early